



Bioremediation of Explosives Contaminated Soil

NSWC CRANE



The mission of NSWC Crane is to provide low cost, quality, and responsive acquisition, engineering, logistics, and maintenance for the Fleet's weapon and electronic systems, ordnance, and associated equipment and components. The 62,463-acre installation is located 75 miles southwest of Indianapolis and 71 miles northwest of Louisville. The handling of explosives at NSWC Crane has resulted in approximately 111,000 cubic yards of explosives-contaminated soil.

Project Summary

Incineration and bioremediation by composting are two proven technologies for the treatment of soil contaminated with the explosives trinitrotoluene (TNT), cyclonite (RDX), and cyclotetramethyle-netetranitramine (HMX). Incineration, although proven effective, is expensive and commonly frowned upon by local communities. Thermophillic biodegradation composting was the technology selected for explosives contaminated soils removed from **SWMU 03/10 Ammunition Burning Ground; SWMU 10/15 Rockeye; SWMU 12/14 Mine Fill A and SWMU 13/14 Mine Fill B**. In composting, organic material is mixed with contaminated soil, which initially contains very little organic material. The added organic materials provide the carbon and nitrogen sources necessary for microorganisms to degrade the explosive compounds present in contaminated soils.

The Crane Bioremediation Facility consists of:

- Three 70 feet wide by 300 feet long compost buildings and associated facilities, including building sumps, two runoff collection ponds, an amendment storage area, office and laboratory trailers, and a decontamination area.
- The compost building sidewalls are concrete to a height of 4 feet with metal siding extending to the roofline. The floors are concrete. The ends of the buildings are open providing ventilation. Ridge vents provide additional ventilation.
- Heavy equipment for the transport and handling of soil, including a Scarab windrow turner.

The composting operation consists of the following sequence of steps:

- Pre-excavation Sampling
- Soil Excavation and Screening
- Post-excavation Sampling
- Load and Mix Amendments
- Load Amendments into Windrows
- Add Soil to Windrow
- Turn/Mix Windrow
- Windrow Sampling
- Unload Windrow and Return Soil to Originating SWMU

Site/Location:	NSWC Crane Crane, IN
Site Description:	Soils bioremediation facility
Team Contact:	Bill Gates (SOUTH DIV), 843-820-7360 Christine Freeman (Crane) Brent Robertson (Crane) Peter Ramanauskas (EPA) Greg Jones (MK)
Technology:	Bioremediation
Contaminant:	TNT, RDX, HMX
Action Levels:	Reduce explosive contaminants to industrial cleanup goals
Legal Driver:	RCRA Part B Permit
Decision Document:	Full-scale Operational Plan and Quality Assurance Project Plan



Figure 1: Steam rises as the windrow turning machine completes a pass through a soil windrow in the biofacility.



Figure 2: Technician takes process measurements of a soil windrow.

Regulatory Requirements/Community Involvement

- The NSWC Crane facility is subject to the requirements of a RCRA Part B permit, administered by U.S. EPA Region 5 in Chicago, Illinois. On-site bioremediation of contaminated media must comply with the approved Full Scale Operational Plan and Quality Assurance Project Plan.
- Based on the U.S. EPA Region 5 classification, the soil is treated as non-hazardous waste. The Bioremediation Facility has been designed and constructed as a solid waste management unit and contaminated media treatment facility meeting the applicable codes, standards, and regulations.

Construction Challenges

The composting facility is the third of its type in DOD and the first in U.S. EPA Region 5. Bench scale and pilot scale testing were performed to confirm applicability of the technology.

Cost Avoidance Measures

- By optimizing the most efficient and effective compost “recipe” during pilot-scale, biodegradation rates were increased. As shown in Figure 4, this has allowed for the processing of increased quantities of soil.
- Figure 5 reflects a reduction in the cost per ton to process soil, attributable to shorter processing times and increased process efficiencies.

Project Successes

- Biological treatment advantages over incineration include the ability to treat on-site with low transportation costs, reduction of long term liability for wastes, and general public acceptance of the bioremediation process.
- Since the beginning of full-scale operations in April 1998, over 10,000 cubic yards of contaminated soil have been treated. Figure 4 charts the progress of composting operations.
- Actual schedule performance continues to be ahead of the planned dates, due primarily to the relatively short bio-degradation period. The average time to reach the cleanup goals is approximately ten days.
- Alternate soil screening equipment has increased the soil production rates.

Lesson Learned

Evaluation of equipment specifications and selection should include testing using samples of all site soil conditions and a variety of compost “recipes.” Changes in soil types affected the type of soil screener used. Original soil screener was ineffective when soil with a higher clay content was encountered. The replacement screener was fully tested before being purchased and placed into use.



Figure 3: Treated soil is returned to Mine Fill A for backfill.

